

# **The Renovation of Boston's South Station**

Term Project

1.011 - Project Evaluation



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*Cover Photo: South Station, May 6, 2003, Will Fowler*

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## Section 1: Background

When John Winthrop and the Puritans founded Boston in 1630, the South Station site was a marshy tidal flat south of the peninsula. In the shipping boom that followed the Revolutionary War, the South Cove area was filled in and used for residential and wharf property. By 1890, however, Boston had become the railroad hub for the Northeast, and the South Cove property was serving as the New England Station for a small railroad. Four other stations cluttered the South End, and the need for a consolidated station was apparent.

As a result, in 1876 the Boston Terminal Company was formed. Made up of the Boston and Albany Railroad Company, the New England Railroad Company, the Boston and Providence Railroad Corporation, the Old Colony Railroad Company, and the New York, New Haven, and Hartford Railroad Company, the Boston Terminal Company drew up plans for a new South Station.

The original station plan called for the use of more than 35 acres of land worth approximately \$9 million 1896 dollars. Much of the land came from razing buildings owned by the New York and New England Railroads, as well as adding a seawall to the Fort Point Channel and filling in the land behind it.

### History of the Station

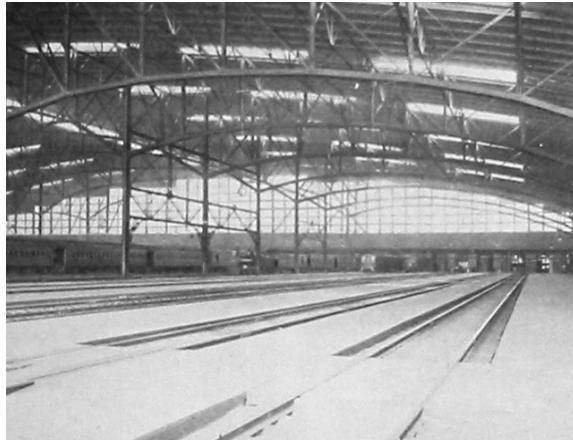
South Station opened on January 1, 1899, to great fanfare. The Boston terminal of five major freight and passenger railroads, South Station became the busiest railroad station in America by 1910. The architecture of the station was equally impressive. The headhouse, situated diagonally to the tracks, was designed



The facade of South Station in the 1920's (Boston Public Library)

with hints of gothic architecture and featured an elevated colonnade and large clock in the facade. The sides of the building, running perpendicular and parallel to the tracks, held five storeys of offices which were originally occupied by the railroad companies. The train shed covered the

passenger platforms and allowed indoor boarding of trains. A vast glass canopy, the train shed was the crowning touch that gave South Station its elegance.



**Inside the train shed in South Station (Boston Public Library)**

Like today's airports, South Station was essentially a small city inside Boston. The station was capable of producing 25 tons of ice per day that was used on the trains and in station restaurants. Four electric generators supplied power to the station, and a gas plant and air compressors serviced the locomotives. A subway ran under the tracks in the

yard, allowing access to baggage and express services. The station also had repair facilities, track maintenance staff, and snow removal facilities.

**Table 1-1: Original Costs of South Station**

Element	Cost (1899 dollars)
Architect Fees	\$57,500
Headhouse	\$2,400,000
Train shed	\$491,000
Express Buildings	\$226,000
Power house	\$346,000
Gas plant	\$83,000
Total	\$3,609,000

The initial track plans also called for a wye track loop under the station to allow trains to turn around. This track was built, but was never used. The switching yard behind the station was a complex jumble of tracks and sidings. The equipment in Tower One, the primary switching tower for the rail yard, had to be custom made and was the world's largest centralized rail switch when it was installed.

### First Renovation

The first major renovation to South Station was to repair the train shed. Less than 20 years after the station's opening, the ocean air and the acidic fumes from the locomotives had corroded the train shed so badly that it required a major overhaul to repair. By 1930, however, the structure was in such bad condition that it was demolished in a \$2.5 million station renovation.



South Station without the train shed (Boston Public Library)

Other changes soon afterwards included adding umbrella platforms to replace the train shed and modernizing the station. The open tracks were walled in from the street, and Terrazzo floors were added. The concourse was also renovated, and the headhouse received a new restaurant and ticketing office. Finally, a movie theater and parking garage were added on the street side.



## Decline of the Railroads

After World War II, the federal government began to focus on highway expansion. The number of rail passengers plummeted as airlines increased service and Americans began driving on vacations. In the early 1950's, a Catholic Chapel, Our Lady of the Railways, occupied the empty Dorchester Avenue side of the terminal. A serious blow to the Station occurred in 1959 when Old Colony passenger service ended, which prompted the already suffering restaurant, drug store, and lunch counter to close. In 1960, the basement of the headhouse contained space for the U.S. Post Office, the New Haven Railroad's public relations department, baggage facilities, vaults, a bowling alley, and a bar.

### ***South Station Information:***

According to the Amtrak train manager at South Station who claimed to have frequented the station as a boy, the Our Lady of the Railways Chapel used to compete with the Our Lady of the Seas Chapel for which could say the fastest Mass.

Conditions worsened as the New Haven Railroad became financially unstable and began negotiations with Boston about property tax relief. The New Haven Railroad slipped into bankruptcy in 1961, and in 1965 South Station was sold to the Boston Redevelopment Authority (BRA) for \$6.95 million. In just ten years, South Station had fallen from the boom days of World War II with over 125,000 passengers per day to a nearly deserted shell housing bankrupt railroads.

The BRA proved to be disinterested owners of a railroad terminal. In the plans for ongoing urban renewal projects there was little space for large railroad terminals downtown. Instead, the

### ***South Station Information:***

According to MIT Professor Fred Salvucci, the only factor that prevented the BRA from tearing down the headhouse was that they couldn't afford to remove the heavy granite walls.

BRA intended to tear down South Station and replace it with a small terminal downtown. Accordingly, in the late 1960s the Dorchester Avenue wing was sold to the Post Office. Originally housing the inbound baggage room,

freight facilities, and some express buildings, the wing was torn down to make room for a new Post Office sorting facility.



The next blow fell in 1972 with the demolition of the Atlantic Avenue express building, then in 1973 when demolition began on the main terminal. Workers began on the Dorchester Avenue end and removed about half the building along Summer Street. In its place was built the new headquarters for the MIT-alumni-founded engineering firm Stone and Webster. In 1976, another piece of South Station was removed to put space between the station and the engineering office.

Also in the early 1970s, several businesses moved out of the five storey wings bordering the headhouse. A fire destroyed much of the third floor, and the fourth and fifth floors were closed because of water damage. The abandoned building became a favored refuge for the homeless, and a crime problem began to emerge which decreased ridership even further.

### **South Station Sold to the MBTA**

By 1978, public interest in the historic station had increased, and the station was listed on the National Register of Historic Places. The BRA sold what remained of the station to the Massachusetts Bay Transportation Authority for approximately \$10 million<sup>1</sup>. The MBTA had already been using South Station for its commuter rail service, but now became interested in the station serving as an intermodal “transportation center.” This transportation center would include not only intercity and commuter rail, but would also contain links to the subway system and local and intercity bus service.

#### ***South Station Information:***

According to the State Transportation Librarian, getting the South Station headhouse listed on the National Register of Historic Places was a clever move by someone at the MBTA trying to convince the BRA to sell the facility.

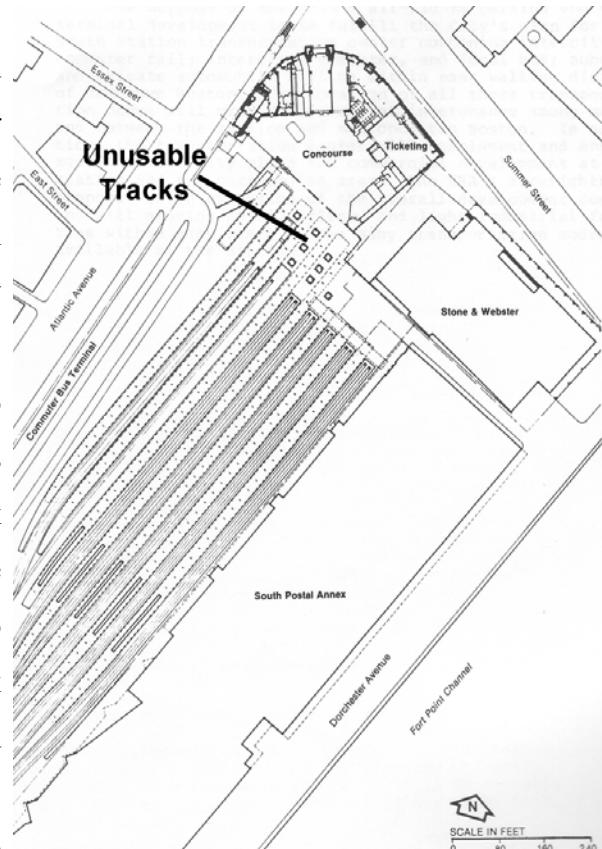
The terms of the sale gave the MBTA ownership of all South Station buildings and tracks, while the BRA retained air rights above the sixth storey. The motivation behind this was that the MBTA could renovate the station and build a bus terminal over the tracks, while the BRA could negotiate with developers for use of the air rights above the station and tracks.

<sup>1</sup> Authors' estimate based on historical data.

## Section 2: Concept of the Renovation

### The 1980s Renovation of South Station

In 1981, the Environmental Impact Statement for the renovation project cited the need for a renovation of the station. With urging from the MBTA, the Federal Railroad Administration proposed “significant improvements to Boston South Station to eliminate current deteriorated conditions in the station building and tracks and provide adequate facilities for the increased patronage projected for 1990” (USDOT EIS 1-1). The Department of Transportation also predicted that the renovation would “constitute a catalyst for economic development in the entire area” because of the need for rapid transit in downtown Boston (USDOT EIS 1-1). The renovation was necessary because of severe deterioration in the headhouse, but other improvements were also necessary to modernize the station. The tracks and platforms were inadequate for heavy usage because the track heads were not convenient to the concourse. The tracks and platforms were also not long enough to accommodate the 12-car trains planned by Amtrak and the MBTA. Also, the platforms were ‘low’ and required a passenger to climb into the rail cars, creating a barrier to the handicapped. Finally, the switches in the tracks were worn out, and the mechanisms required frequent maintenance.



Layout of South Station in 1980 (USDOT EIS 1-5)

The goal of the renovations was “to promote and accommodate future rail passenger



“demand” (USDOT EIS 1-4). In 1981, ongoing improvements to the Northeast Corridor included faster travel times, more comfortable trains, and more dependable schedules. In 1975, 537,000 Amtrak passengers passed through South Station. The number was projected by the Department of Transportation to be 923,000 passengers in 1990. Commuter rail ridership was expected to increase from 2,774,000 in 1975 to 3,834,000 in 1990.

With the goal of renovating the station clear, several alternatives were proposed.

#### **Alternative One: No-Build**

This alternative would make no improvements to the building, track, or platforms. It would allow corridor improvements to increase ridership, while the station would remain unchanged.

#### **Alternative Two: Maintenance**

Alternative two would involve a repair and maintenance program that would preserve the headhouse, east wing, and concourse from further damage, and repairs would be done on an as-needed basis. Minor repairs would be done in areas where the damage threatened public safety.

#### **Alternative Three: Partial Build - Station and Track**

Alternative three would consist of major renovation of the station, reconstruction of the tracks and switches, and improvements to commuter rail facilities. The FRA estimated that these repairs would cost \$25.85 million for the station renovation. The Federal Government would provide \$18.3 million for the renovation under the 4R Act, while a local agency would be responsible for another \$7.5 million. The parts funded by the federal government included (USDOT EIS 2-3 - 2-6):

- Site work, local signals, track relocation, and interlocking reconfiguration.
- Renovation of the station building including construction of a new concourse and a mezzanine level in the waiting room.
- Rehabilitation of the heating, ventilating, and air-conditioning; plumbing; and electrical

systems.

- Improvement of intercity passenger processing and support systems including ticketing, baggage, and package express facilities.
- Improvement of intercity platform access, including trainroom construction.
- Construction of two new high-level intercity platforms.
- Provision of new information systems, including signage and trainboards.
- Elimination of code deficiencies, including reconstruction of fire exits and fire protection systems.
- Improved handicapped accessibility, including elevators and special hardware.

The improvements that would be split between the MBTA and the FRA included:

- Construction of three new high-level commuter platforms.
- Improvement of commuter platform access.
- Construction of escalators and stairs to the Red Line subway station.
- Construction of additional auto pickup / drop-off areas.

Finally, improvements funded by the MBTA, BRA, or the Urban Mass Transit Authority (UMTA) would include:

- Construction of tracks and interlockings not included in the federally-funded improvements but required by commuter rail operations.
- Construction of one new high-level commuter-side platform.
- Renovation of floors 3, 4, and 5 of the headhouse for rental office space.
- Renovation of second-floor areas in the headhouse for retail rental space.
- Construction of a new service tunnel and service core.

#### **Alternative Four: Partial Build - Station, Track, and Parking**

Alternative four would include all the improvements from alternative three, but would also



include the construction of a “500-space air-rights parking deck above the track area” (USDOT EIS 2-6). The parking garage would be funded jointly by the FRA and the MBTA, and would include pedestrian access to the headhouse. The parking deck would require moving city sewers, which would be paid for by the MBTA and FRA.

#### **Alternative Five: Partial Build - Station, Track, Parking, and Bus Terminal**

Alternative five included all the improvements in alternative three, plus the development of “3 air-rights levels containing a bus terminal and parking to accommodate approximately 800 cars for both short- and long-term parking” (USDOT EIS 2-8). The funding for the terminal renovations would be similar to that of alternative four, while construction of the bus terminal would be funded by a UMTA grant of \$60 million to the MBTA (Grant MA-02-0088, approved 25 September, 1979). Alternative five also included (USDOT EIS 2-8):

- Headhouse extension – five-storey extension to the west wing of the headhouse reminiscent of a portion of the original Atlantic Avenue facade; the first and second floors of the new wing would be designed for retail concession space and the remaining three floors for office space.
- Redesigned pickup/drop-off area along Atlantic Avenue.
- Air-rights level 1 (AR-1) – Commuter bus concourse, intercity bus passenger processing and package express, short-term parking for approximately 200 cars, pedestrian concourse from second floor of headhouse overlooking trainroom and Atlantic Avenue, and entrance and exit ramps for the package express and service vehicles from Kneeland Street.
- Air-rights level 2 (AR-2) – 40 loading bays for intercity buses and pull-through islands that can accommodate up to 21 commuter buses; access for buses via two ramps, one from Kneeland Street and the other directly from the Massachusetts Turnpike; bus exit via one ramp to Kneeland Street.
- Air-rights level 3 (AR-3) – Long-term parking area for approximately 600 cars; entry and exit to the parking levels (AR-1 and AR-3) are provided by the single-land spiral ramps on



Atlantic Avenue; exit only to Kneeland Street for automobiles is also provided via the service ramp on AR-1.

### **Alternative 6: Full Build**

Alternative six was the most construction-intensive and was the alternative that was ultimately chosen for the renovation. It consisted of two phases: phase 1 was to be completed by 1985, while phase II would be implemented by 1990. Phase I incorporated all the elements of alternative five, plus the construction of foundations to support Phase II air-rights development. Phase II was originally proposed to include (USDOT EIS 2-12):

- The office tower – a 12 - 14 storey, 400,000 square foot office tower located closest to the headhouse on a 35,000 sqft area on AR-3 over the bus terminal. The estimated cost was \$40 million 1979.
- The hotel tower – an approximately 100,000 sqft development pad on AR-4 directly south off the office tower would contain the public elements (lobby, convention facilities, restaurants) and the first floor of the 25-storey hotel tower. The estimated cost was \$60 million 1979.
- Low-rise development – The southernmost area, a 125,000 sqft space on AR-6, would be developed as a two-storey structure suitable for high-tech industries. The estimated cost was \$20 million 1979.

### **Opposition and Controversy**

Very little public opposition to the proposed renovation occurred. Several individuals expressed concerns about the destruction of historic Tower One which was required in the modernization of the tracks, but the equipment from the tower was donated to a museum and so the historical significance of the tower was preserved. The only formal opposition to the plan came from the Stone and Webster building managers, who worried that an increase in rail traffic through



South Station would adversely affect air quality in their headquarters. This concern was dealt with by a slight change in plans for ventilation which pointed the exhaust vents away from the Stone and Webster buildings.

### **Risks and Uncertainty**

The risks inherent to the project were that rail ridership would not increase and that the station would again slip into disrepair. These risks were reduced in several ways. Because so much of the renovation money came in the form of federal grants, there was little risk to the MBTA of criticisms or low return on investment. The financial arrangements with Equity Office Properties, discussed in the financial analysis section, also helped take away much of the risk from the MBTA. Overall, this project was fairly low-risk. Commuter and intercity rail already had solid ridership numbers, and all estimates predicted these numbers to continue growing. Likewise, bus and subway service was consistent and growing, and consolidating these services into one facility would generate enough traffic, even by 1975 numbers, to attract commercial concession investments.

## Section 3: Financial Analysis

### Funding and Costs

The money for the renovation of South Station came from a combination of sources, as discussed in the construction alternatives. The estimated costs of construction were lower than the actual costs, as shown in table 3-1 below (source is USDOT EIS unless otherwise noted).

**Table 3-1: Estimated Costs of Renovation**

Category	Estimated Costs (1981)	Source of Funding
Site work: Renovation of headhouse & tracks, improvements of platforms, etc.	\$10.7 million	FRA Grant
Construction of Commuter platforms, Red Line subway access, auto drop-off	\$15.2 million	\$7.6 million from MBTA \$7.6 million from FRA matching Grant
Renovation of 3 <sup>rd</sup> , 4 <sup>th</sup> , and 5 <sup>th</sup> floors in headhouse, renovation of retail space	\$8 million <sup>2</sup>	Equity Office Properties
Construction of intercity bus terminal	\$60 million	UMTA Grant
<b>Total Phase I:</b>	<b>\$93.9 million</b>	

<sup>2</sup> Estimates by authors based on interviews.

Phase II	\$120 million <sup>3</sup>	Tufts Development Corporation / BRA
<b>Total:</b>	<b>\$213.9 million</b>	

Specific deals that the MBTA negotiated included an agreement with Equity Office Properties. This agreement dictated that the MBTA owned the South Station headhouse and leased it to Equity Offices. Equity was allowed to develop the station and then sub-lease space to businesses such as concessions and booksellers in the terminal, as well as office space in the building above. They would also be responsible for the maintenance and day-to-day operations of the facility. Equity would deduct costs of operations from all revenue received, and would then evenly split the profits with the MBTA.

As construction got underway, several issues affected the construction and renovation. First of all, negotiations with Amtrak and the Tufts Development Corporation delayed the construction of the bus terminal, which did not open until 1993 - five years behind schedule. The location of the bus terminal over the tracks required either that vast ventilation shafts be installed or that Amtrak and the MBTA not use diesel engines in the enclosed space. Amtrak refused to convert its engines to electric power as they entered the station, nor would they change their schedules to allow the trains to back into the station. As a result, the bus station that eventually was constructed was only half built. The space adjacent to the headhouse was left open for ventilation.

Another issue that affected the construction was cost overruns.



An empty space above the tracks where the bus terminal should be, and space for the walkway.

<sup>3</sup> USDOT EIS 2-12

**Table 3-2: Actual Costs of Renovation**

Category	Actual Costs (2001 \$) Actual Cost (1981 \$) (CPI = 194.6 <sup>4</sup> ) (Difference between 1981 actual and 1981 estimate)	Source of Funding (2001 \$)
Site work: Renovation of headhouse & tracks, improvements of platforms, etc.	\$48.8 M <sup>5</sup> \$25.1 M (\$14.4 M)	FRA Grant
Construction of Commuter platforms, Red Line subway access, auto drop-off	\$55.2 M <sup>6</sup> \$28.4 M (\$13.2 M)	\$27.6 million from MBTA \$27.6 million from FRA matching Grant
Renovation of 3, 4, and 5 floors in headhouse, renovation of retail space	\$15.6 M <sup>7</sup> \$8 M (\$0 M)	Equity Office Properties
Construction of intercity bus terminal	\$83 M <sup>8</sup> \$42.7 M (\$-17.3 M) (half built)	UMTA Grant
<b>Total Phase I:</b>	<b>\$195 million<sup>9</sup></b> <b>\$100.2 million</b> <b>(\$6.3 M)</b>	

<sup>4</sup> US Bureau of Labor Statistics

<sup>5</sup> Kay 30

<sup>6</sup> Estimate by authors based on other figures.

<sup>7</sup> Estimates by authors based on interviews.

<sup>8</sup> Massachusetts Bay Transportation Authority. Capital Investment Program, FY2004-FY2008. 131.

<sup>9</sup> Nellgan 41.

Phase II (estimates):	\$233.5 M <sup>10</sup> \$120 M (\$0 M)	Hines Development Corporation <sup>11</sup> / BRA
Track & bus terminal Improvements, ventilation	\$17 M <sup>12</sup>	Hines Development Corporation / BRA
City of Boston Linkage Payments	\$11.9 M <sup>13</sup>	Hines Development Corporation
<b>Total Phase II:</b>	<b>\$262.4 M \$134.8 M (\$14.8 M)</b>	
<b>Total Project:</b>	<b>\$457.4 M \$235.0 M (\$21.1 M)</b>	

These cost overruns occurred for several reasons. The majority of the overage was a result of unexpected problems with removing tracks and reconstructing underground sewage and utility lines. Huge overruns associated with Big Dig work also occurred in making the connection between the Red Line and the first floor of South Station.

## Revenues and Benefits

Because of the grants and the agreement with Equity Office Properties, the MBTA ended up investing money only in the initial purchase of South Station and in the construction of the Red Line

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<sup>10</sup> USDOT EIS 2-12

<sup>11</sup> Tufts Development Corporation sold the air-rights to Hines Development Corporation because the vibrations from the train traffic made the site unsuitable for high-tech firms, which is what Tufts had intended for the area.

<sup>12</sup> Hines 6

<sup>13</sup> Hines 6

connection. Table 3.3 shows the actual expected recoverable costs to the MBTA and to Equity Office Properties.

**Table 3-3: Expected Recoverable Costs**

Investor	Category	Costs (2001 \$)
MBTA	Purchase of South Station	\$19.46 million
MBTA	Red Line Connection	\$27.6 million
Equity Office Properties	Renovation of commercial space	\$15.6 million

Actual revenues from the arrangement between the MBTA and Equity Office Properties were not available. The MBTA groups all non-government revenue into one category, while Equity does not release specific financial data. However, a number of assumptions can be made, as shown in table 3.4, based on similar projects elsewhere. Profits examined are presumed to come not from ticket sales (a separate and complex portion of the MBTA that funds track and rolling stock maintenance), but from money spent by passengers in concessions passing through the station and from revenue from office leases. It is assumed that Equity and the MBTA's fees for use of space in the headhouse are in some way linked to actual profits of businesses. Further assumptions are then made regarding the amount spent per type of traveler every time they pass through the station.

Table 3.4 is based on 1975 figures estimating ridership in 1990 (BRA). The BRA Program Analysis initially predicted higher levels of bus activity but was adjusted to account for passengers leaving busses to use expanded train services. That means these are numbers that might have been predicted when considering the renovation of South Station. Estimated passenger spending are the authors' estimates.

**Table 3-4: 1975 Estimate of South Station Traffic in 1990<sup>14</sup>**

Service	Passengers/yr	Gross Estimated Spending	Total
Intercity Rail	3,023,000	\$2	\$6,046,000
Commuter Rail	2,800,000	\$0.50	\$1,400,000
Intercity Bus	3,376,000	\$1	\$3,376,000
Office Rental	221,000 sq ft	\$29/sqft	\$6,409,000

After the profits have been evenly divided, the MBTA would potentially receive yearly revenue, based on this predicted model year, of approximately \$8.6 million.

Some figures are much more variable than others. For example, the cost of office space in downtown Boston can vary from \$20/sf to as much as \$35/sf. Table 3.5 shows the effect of different office space charges.

**Table 3-5: Effect of Office Space Charges**

Office Space Sq ft	Cost of Office Space/ sqft	Total Profit (MBTA profit)	Change from Predicted Year (for MBTA)
221,000	\$29	\$6,409,000 (\$3,204,500)	0
221,000	\$20	\$4,420,000 (\$2,221,000)	- \$983,500
221,000	\$35	\$7,735,000 (\$3,867,500)	+\$663,000

Because the equations involved here are simple linear multiplicative functions, an increase in the price of office space of 50% will result in a 50% increase in office revenue. Because of this, the price of office space may vary from the expected value by as much as -30% / +15%. This can

<sup>14</sup> In this table, Gross Estimated Spending represents the estimated monetary receipt per passenger received by Equity Office Properties, which would then be split evenly with the MBTA.

result in a change in total revenue as great as  $-11\% / +6\%$ . Without further expansion, the amount of office space in the headhouse is fixed, making this the only expected change in office space revenue. Even in poor economic times, it is unlikely that high quality office space in downtown Boston would go for less than \$20/sf (/year) or that it would remain empty for any significant period of time.

Ridership is a much more variable number, though. Over a decade, ridership could potentially decrease to as little as half or as much as double current (in this case predicted) values. Yearly maximum change is likely to be on the order of 10%. Table 3.6 summarizes some possible effects.

**Table 3-6: Effects of Changes in Ridership**

Change	Effect on MBTA Profits
All ridership increases 10%	+6.2% total MBTA profit
All ridership decreases 10%	-6.2% total MBTA profits
Inter-city Travel increases 10%, Commuter travel decreases 10%	+4.6% total MBTA profits
Inter-city Travel decreases 10%, Commuter travel increases 10%	-4.7% total MBTA profits

Interestingly, fluctuations in office space, which might occur within a few years, could actually have a larger effect on revenues than reasonable changes in ridership. When focusing purely on the headhouse and not ticket prices and costs for actual transportation services, the office space is clearly an important part of the South Station project.

These numbers for profit / passenger are most likely to vary as the economy changes, as seasons change (people will buy hot coffee in the winter, but might not replace that with a cold fruit drink in the summer), and as individual businesses in the headhouse change. Also, these estimates have the greatest variability simply because they involved more extrapolation and prediction than any of the other numbers used.

Table 3-7 assumes that a change of +/-75% may occur, and that a change of +/-25% at most is likely to occur.

**Table 3-7: Effects of Passenger Spending**

Profit change if all spending change by 75% (extreme case)	+/- 47% of total MBTA earnings
Profit change if all spending change by 25% (more likely case)	+/- 16% of total MBTA earnings

It is clear that uncertainty due to changes in passenger tendencies and inherent in our estimation process can potentially exert a much larger influence on South Station's profits than any other factor by itself is likely to. Tables showing several possibilities including variability in several areas simultaneously can be found in Appendix A.

### Actual Results

The renovation and construction of the bus terminal produced very dramatic results and effects on ridership. Table 3.8 summarizes the actual ridership numbers in 1990 and 2001.

**Table 3-8: Actual Ridership from South Station in 1990 and 2000<sup>15</sup>**

Service	Passengers / year (1990)	Passengers / year (2001)
Intercity Rail	839,000	1,060,000
Commuter Rail	12,000,000	18,000,000
Intercity Bus	0 <sup>16</sup>	3,000,000
Office Rental	221,000 sqft	221,000 sqft

<sup>15</sup> MBTA Ridership and Service Statistics, 1991, 2001.

<sup>16</sup> The South Station bus terminal did not open until 1993.

Using the actual ridership numbers, it is possible to predict revenues for the MBTA and Equity Office Properties. Table 3.9 summarizes these figures.

**Table 3-9: Estimated Profits in 1990 and 2001<sup>17</sup>**

	<b>1990 (2001 \$)</b>	<b>2001 (2001 \$)</b>
Total Profit Received	\$14,087,000	\$20,529,000
Profit for Equity Office Properties (50%)	\$7,043,500	\$10,264,500
Income for MBTA (50%)	\$7,043,500	\$10,264,500

A comparison for the MBTA's expenses vs. income shows that the renovation of South Station was financially beneficial. Their expenses were the cost of purchasing the station (\$19.46 million) and the cost of Red Line connection (\$27.6 million) for a total of \$47.06 million in expenditures. If they financed this by floating bonds, their total cost would probably total \$55 million. If yearly receipts range from \$7 million to \$10 million, the MBTA would begin making a profit within seven years.

Expenditures for Equity Office Properties were lower, as they only paid for the renovation of concession and office space (\$15.6 million). If their yearly profits are equal to the MBTA's yearly receipts from South Station concessions (\$7 million to \$10 million), they would begin making a profit within three years.

#### **Other Points Of View:**

This economic analysis was based a subset of the MBTA that is concerned with ownership of the headhouse itself but not of actual transportation lines or even related facilities (tracks or

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<sup>17</sup> In this table, Gross Estimated Spendings represents the estimated monetary receipt per passenger received by Equity Office Properties, which would then be split evenly with the MBTA.



rolling stock). South Station's economic viability can be evaluated from a large number of view points because of the large number of stakeholders and contributors, including the MBTA, Equity Offices, Beacon Management (the original manager of the bus terminal) and now Codman's, the Federal Government, and Boston citizens, riders and taxpayers.

An in depth analysis, or even a summary analysis as was done above, addressing each possible group of stakeholders would be extremely lengthy and tiresome. Below is a quick summary of issues that would be relevant to some different possible stakeholders.

### **Federal Government:**

Much of the funding for South Station's renovation was provided by the Federal Government. Money from the Federal Railroad Administration was marked specifically to support intercity rail.

Economically, South Station would be a pure expenditure for the federal government, with no immediately traceable monetary income. Analysis would necessarily focus on non-monetary benefits. These would include the pollution reduction that comes with any project that takes cars off the road, the benefits to individuals who could now travel between cities that might have been unable before, and the general increase in public good that comes with increasing transportation opportunities and choices.

### **The Complete MBTA**

If looking at the MBTA as a whole, and not just the ownership of the headhouse, the analysis would have to take into account costs and revenues from Commuter Rail. Clearly, Commuter Rail simply could not exist without some kind of terminal station, and the quality of that station will affect operating costs and ridership. Secondary effects such as how this affects ridership on the Red Line, which includes a South Station stop, must also be included in the analysis from this point of view.

## Equity Office Properties

The developer and operator of office space and concession space in South Station would have an initial investment in renovation, and continuing operating expenses. They also might have future further renovation costs. Their income would come from leases of space, which is then split with the MBTA.



Inside South Station today

## An Average Commuter

The project can even be evaluated from the perspective of a potential commuter. Their expenses would include a portion of their taxes going to purchase South Station originally, and going to finance the MBTA. Their most direct expenses would be tickets. This could be weighted against the cost of owning and operating a motor vehicle, or of operating it significantly more than they would if they could take a train. All these costs can be viewed as an opt-in fee for taking part in a job in the Boston area.

## The Public

In the hands of the Massachusetts Bay Transportation Authority, South Station is fundamentally a public project and should improve the welfare of people in the area. In this regard South Station is a notable success in various ways.

**Historic preservation:** When first constructed over a hundred years ago, South Station was both a functional hub for passenger rail traffic and an architecturally impressive anchor building in downtown Boston. Ongoing renovations have helped preserve the original building and maintain much of its aesthetic style. It is one constant and impressive feature in a downtown area that is



constantly changing.

South Station is also historically interesting as a station. More than two dozen famous trains have made their first journey from South Station. The continuing operation of South Station is a success for rail history as well as for current passengers.

**Bus Service:** The renovation of South Station made possible the construction of an integrated bus terminal, bringing together Greyhound, Trailways, and several smaller carriers in a single location. While the intercity bus facilities in downtown Boston were once a “very old, smelly, dilapidated facility, a typical bus station” (Brenner), South Station now contains a very secure, functional, clean, and friendly bus facility. In connecting commuter rail, intercity rail, and intercity bus service, South Station is now a model intermodal transportation center, and perhaps “the best bus facility in the country” (Brenner).

**Commuter Rail:** Over the last several decades, Boston’s extensive Commuter Rail program has been a great success. Ridership has far exceeded predicted numbers and is now one of the most popular mass-transit systems in Massachusetts. This availability and use of public transportation is useful for commuters who have a cheap and easy way to get to work, to shopping, and to any other location in the city. Public transportation also helps relieve the congestion in Boston area roads and parking lots. Finally, public transportation is good for the environment, drastically reducing use of fossil fuels and harmful emissions into the atmosphere.

As one of the two terminal stations for MBTA Commuter Rail, serving more than half of its riders, South Station is a crucial cog in this machine of public transportation.

**Intercity Rail:** Intercity rail along the Northeast Corridor is everything that Commuter Rail is on a different scale. It is good for travelers, creating a simple and comfortable way to travel long inter-city distances. It helps remove congestion on highways connecting major cities. And it protects the environment every time it saves a long trip by car.

## Section 4: Conclusion

When compared to the plans laid in the 1970s, the progress made on South Station seems inadequate. The current bus terminal is only half of what was planned and was still completed ten years behind schedule. The air rights development, including parking and valuable downtown space, is currently almost twenty years behind schedule. Intercity rail, a significant portion of South Station's business, has fallen behind predictions in the more than twenty years since South Station's renovation began. But despite these negative facts, the renovation of South Station has actually been a major success.

South Station today is a clean, busy, vibrant intermodal intersection. It plays a crucial role in supporting the MBTA's very successful commuter rail and in supporting intercity rail, including the new and successful Acela high speed train. The partially completed bus station is a huge improvement over what previously existed in Boston and a much more pleasant experience than most bus stations.



South Station Bus Terminal



Amtrak's Acela and the MBTA Commuter Rail co-exist at South Station

The future of South Station continues to look bright. Hines Development Corporation is nearing the end of the permitting process to develop air rights above South Station tracks (Brenner). This development will be accompanied by the required expansion of the bus terminal. Predictions for continuing use of rail and bus services imply that South Station in the first few decades of the twenty first century will be as successful as it was in the beginning of the twentieth.

## Future Development

Since the completion of the first half of the bus terminal, construction at South Station has been at a stand still. The second half of the bus terminal and development of air rights beyond have stalled due to redesigns, permitting trouble and debate over foundation placement.

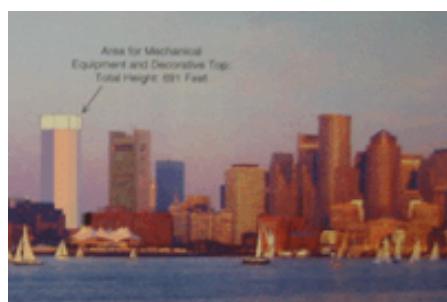
Foundations for air rights development were placed during track renovation in the 1980s, but designed to support a slightly different payout than the Hines Development Corporation wanted. Negotiations have led to a compromise that uses current foundations and makes minimal modifications without interrupting train service, while meeting Hines' needs for a significantly larger (up to 40 stories, as opposed to originally 12-14 stories) building (Salvucci).



The cement stumps between the tracks are some of the foundations for the future air-rights developments.

The horizontal extent of air rights over the headhouse itself has also been debated by the BRA, the MBTA and Hines, but the again a compromise has been attained that suits all parties. With a slight reduction in height to satisfy the FAA, final designs for air rights development are currently in the City Of Boston permitting process (Brenner). The first phase of construction will

necessarily involve the completion of the bus terminal, and continuing construction will be only a matter of the Hines Corporation securing financing.



The proposed Hines office tower  
(Hines)

## Appendix A: Financial Sensitivity Analysis

Each of the following scenarios varies ridership estimates, the rental value of office space and/or the estimated profit/traveler. The base case uses a rental value of \$29/square foot (per year) and ridership estimates that correspond to 1975 estimates of 1990 traffic (BRA). This is the same as the base case discussed in the text.

### Base Case

Service	Ridership/Space	Profit/unit	Total Income	MBTA Profit
Inter-City Rail	3,023,000	\$2.00	\$6,046,000	\$3,023,000
Commuter Rail	2,800,000	\$0.50	\$1,400,000	\$700,000
Inter-City Bus	3,376,000	\$1.00	\$3,376,000	\$1,688,000
Office Space	221,000	\$29.00	\$6,409,000	\$3,204,500
			MBTA Profit =	\$8,615,500

### Inputs:

Ridership increases by 10%

Price of office space falls to \$20/square foot

Service	Ridership/Space	Profit/unit	Total Income	MBTA Profit
Inter-City Rail	3,325,300	\$2.00	\$6,650,600	\$3,325,300
Commuter Rail	3,080,000	\$0.50	\$1,540,000	\$770,000
Inter-City Bus	3,713,600	\$1.00	\$3,713,600	\$1,856,800
Office Space	221,000	\$20.00	\$4,420,000	\$2,210,000
			MBTA Profit =	\$8,162,100
			Change From	
			Base Case	-\$453,400
			% Change	-5.3%

**Inputs:**

Ridership decreases by 10%

Price of office space climbs to \$35/square foot

Service	Ridership/Space	Profit/unit	Total Income	MBTA Profit
Inter-City Rail	2,720,000	\$2.00	\$5,440,000	\$2,720,000
Commuter Rail	2,520,000	\$0.50	\$1,260,000	\$630,000
Inter-City Bus	3,038,400	\$1.00	\$3,038,400	\$1,519,200
Office Space	221,000	\$35.00	\$7,735,000	\$3,867,500
			MBTA Profit =	\$8,736,700
			Change From	
			Base Case	\$121,200
			% Change	1.4%

**Inputs:**

Ridership increases by 10%

Price of office space climbs to \$35/square foot

Service	Ridership/Space	Profit/unit	Total Income	MBTA Profit
Inter-City Rail	3,325,300	\$2.00	\$6,650,600	\$3,325,300
Commuter Rail	3,080,000	\$0.50	\$1,540,000	\$770,000
Inter-City Bus	3,713,600	\$1.00	\$3,713,600	\$1,856,800
Office Space	221,000	\$35.00	\$7,735,000	\$3,867,500
			MBTA Profit =	\$9,819,600
			Change From	
			Base Case	\$1,204,100
			% Change	14.0%

**Inputs:**

Ridership decreases by 10%

Price of office space falls to \$20/square foot

Service	Ridership/Space	Profit/unit	Total Income	MBTA Profit
Inter-City Rail	2,720,000	\$2.00	\$5,440,000	\$2,720,000
Commuter Rail	2,520,000	\$0.50	\$1,260,000	\$630,000
Inter-City Bus	3,038,400	\$1.00	\$3,038,400	\$1,519,200
Office Space	221,000	\$20.00	\$4,420,000	\$2,210,000
			MBTA Profit =	\$7,079,200
			Change From	
			Base Case	-\$1,536,300
			% Change	-17.8%

**Inputs:**

Ridership constant

Price of office space constant

Unit profit estimates increased

Service	Ridership/Space	Profit/unit	Total Income	MBTA Profit
Inter-City Rail	3,023,000	\$3.00	\$9,069,000	\$4,534,500
Commuter Rail	2,800,000	\$1.00	\$2,800,000	\$1,400,000
Inter-City Bus	3,376,000	\$2.00	\$6,752,000	\$3,376,000
Office Space	221,000	\$29.00	\$6,409,000	\$3,204,500
			MBTA Profit =	\$12,515,000
			Change From	
			Base Case	\$3,899,500
			% Change	45.3%

**Inputs:**

Ridership constant

Price of office space constant

Unit profit estimates decreased

Service	Ridership/Space	Profit/unit	Total Income	MBTA Profit
Inter-City Rail	3,023,000	\$1.50	\$4,534,500	\$2,267,250
Commuter Rail	2,800,000	\$0.25	\$700,000	\$350,000
Inter-City Bus	3,376,000	\$0.50	\$1,688,000	\$844,000
Office Space	221,000	\$29.00	\$6,409,000	\$3,204,500
			MBTA Profit =	\$6,665,750
			Change From	
			Base Case	-\$1,949,750
			% Change	-22.6%

**Inputs:**

Ridership increases by 10%

Price of office space climbs to \$35/square foot

Unit profit estimates increased

Service	Ridership/Space	Profit/unit	Total Income	MBTA Profit
Inter-City Rail	3,325,300	\$3.00	\$9,975,900	\$4,987,950
Commuter Rail	3,080,000	\$1.00	\$3,080,000	\$1,540,000
Inter-City Bus	3,713,600	\$2.00	\$7,427,200	\$3,713,600
Office Space	221,000	\$35.00	\$7,735,000	\$3,867,500
			MBTA Profit =	\$14,109,050
			Change From	
			Base Case	\$5,493,550
			% Change	63.8%

**Inputs:**

Ridership decreases by 10%

Price of office space falls to \$20/square foot

Unit profit estimates decreased

Service	Ridership/Space	Profit/unit	Total Income	MBTA Profit
Inter-City Rail	2,720,000	\$1.50	\$4,080,000	\$2,040,000
Commuter Rail	2,520,000	\$0.25	\$630,000	\$315,000
Inter-City Bus	3,038,400	\$0.50	\$1,519,200	\$759,600
Office Space	221,000	\$20.00	\$4,420,000	\$2,210,000
			MBTA Profit =	\$5,324,600
			Change From	
			Base Case	-\$3,290,900
			% Change	-38.2%



## Appendix B: List of Sources

Brennan, Michael. Personal Interview. 6 May 2003.

Boston Redevelopment Authority. South Station Intermodal Transportation Center: Program Analysis #1. Boston: BRA, 1975.

OfficeFinder. "Boston Office Space Information." 8 May, 2003. <<http://www.boston-office-space.com/>>

Hines / TUDC. South Station Air Rights Project, Project Update. Boston: Hines Development Corporation, January 2003.

Holye, Stephen J. "South Station: Its Construction, Architecture, and History." Shoreliner. 1989: 6-32.

Kay, Jane Holtz. "Cheering Restoration of Boston's South Station." Progressive Architecture. 8.90 (1990): 30-31.

Massachusetts Bay Transportation Authority. Capital Investment Program, FY2004-FY2008. Boston: MBTA, 2003. <<http://www.mbta.com/insidethet/pdf/FY04CIPWeb.pdf>>

Massachusetts Bay Transportation Authority. Operations Directorate Planning Division. Ridership and Service Statistics. Boston: MBTA, 1988.

Massachusetts Bay Transportation Authority. Operations Directorate Planning Division. Ridership and Service Statistics. Boston: MBTA, 1991.

Massachusetts Bay Transportation Authority. Ridership and Service Statistics. Boston: MBTA, 2001.

National Railroad Passenger Corporation. "Amtrak Facts." 8 May, 2003. <<http://www.amtrak.com/about/amtrakfacts.html>>

Nellgan, Tom. "Boston South Station Revival." Trains. June 1989: 38-42.

Salvucci, Fredrick. Personal Interview. 1 May 2003.

Sandborne, George. Personal Interview. 6 May 2003.

United States. Department of Transportation, Federal Railroad Administration. Final Environmental Impact Statement, 4(f) Statement: South Station Improvement Project. Washington: GPO, 1981.

United States. Bureau of Labor Statistic. Consumer Price Index - Trend Indicator - 1981. <[http://www.usdoj.gov/jmd/budgetsummary/btd/1975\\_2002/btd01cpi1981.htm](http://www.usdoj.gov/jmd/budgetsummary/btd/1975_2002/btd01cpi1981.htm)>